



University of Crete
Department of Physics

Physics Colloquium

Thursday, 3 November 2022 | 17:00 – 18:00, Online with ZOOM

How large is the proton? A modern puzzle

Prof. Randolph Pohl

Johannes Gutenberg-Universität Mainz

Institut für Physik, QUANTUM und Exzellenzcluster PRISMA+, Germany

ABSTRACT

Protons and neutrons, the building blocks of atomic nuclei, are not elementary particles, but composed of quarks and gluons. The size of the proton, i.e. how large this "fuzzy ball of charge" is exactly, is relevant for a variety of fields in physics. Elastic electron proton scattering was the first to measure the proton size in the 1950s, and since the 1990s, precision spectroscopy of atomic hydrogen (one proton, orbited by one electron) has also been able to determine the proton size. The values seemed to agree until 2010. A very different result was obtained in our experiment using the exotic "muonic" hydrogen atom [1], where the electron is replaced by a much heavier muon. This modern puzzle [2] may now slowly reaching its resolution.

[1] R. Pohl et al. (CREMA Collaboration), *Nature* 466, 213 (2010).

[2] J.C. Bernauer and R. Pohl, *Scientific American*, February 2014.